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SKIN WHITENING AGENT FOR EXTERNAL USE
[BIHAKUYOU HIFU GAIYOUZAI]

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[Scope of Patent Claims]

[Claim 1] A skin whitening agent for external use, characterized in that a plant extract of the genus *Equisetum* (excluding *Equisetum giganteum*) belonging to the family *Equiseatae* is added.

[Claim 2] The skin whitening agent for external use according to claim 1, wherein the plant of the genus *Equisetum* belonging to the family *Equiseatae* is *Equisetum arvense L.*, *Equisetum hyemale L.*, or *Equisetum debile Rox b.*

[Claim 3] The skin whitening agent for external use according to claim 1 or 2, wherein the amount of the plant extract of the genus *Equisetum* belonging to the family *Equiseatae* added is 0.005 to 20.0 wt %.

[Detailed Description of the Invention]

[0001]

[Industrial Field of the Invention] The present invention relates to a skin whitening agent for external use that contains a plant extract of the genus *Equisetum* belonging to the family *Equiseatae* and thereby prevents melanin production and is useful in the prevention and improvement

of pigmentation, discoloration, freckling, liver spots, and the like associated with sunburn.

[0002]

[Prior Art] Although the mechanism by which skin discoloration, and the like occurs is still not fully understood, in general it appears that melanin pigment is formed as a result of hormone anomalies and irritation by UV rays from sunlight, and this pigment is abnormally deposited in the skin. This melanin pigment that is the cause of skin coloration is produced in the melanin-producing granules (melanosomes) inside the melanin cells (melanocytes) between the epidermis and dermis, and the resulting melanin spreads to adjacent cells by infiltration. The biochemical reaction in these melanocytes is estimated to be as follows. In essence, the route of melanin production is the route whereby the essential amino acid tyrosine is converted to dopaquinone by the enzyme tyrosinase and this dopaquinone is converted to red pigment and colorless pigment and then to black melanin by enzymatic or nonenzymatic oxidation. Consequently, inhibition of tyrosinase, which is the first step of the reaction, is essential to the prevention of melanin production.

[0003]

[Problems to Be Solved By the Invention] However, because with the exception of hydroquinone, compounds that inhibit tyrosinase are extremely slow-acting, their effects in terms of improving skin pigmentation are insufficient. On the other hand, although hydroquinone is temporarily effective, it has sensitization capability and its use is therefore generally limited. Consequently, attempts have been made to convert hydroquinone to a higher fatty acid monoester or alkyl monoether in order to improve safety thereof (JP (Kokai)58-154507), but esters are not necessarily safe because they are broken down by in vivo hydrolases, and there are no ethers that a satisfactory in terms of safety.

[0004]

[Means for Solving Problems] Therefore, the inventors studied the melanin production-inhibiting effects of a wide variety of substances in order to solve these problems; as a result, they successfully perfected the present invention upon discovering that a plant extract of the genus *Equisetum* belonging to the family *Equiseatae* has melanin production-inhibiting activity and tyrosinase-inhibiting activity. With regard to the melanin production-inhibiting activity, and the like of plant extracts of the genus *Equisetum* belonging to the family *Equiseatae*, the applicant

of the present application reported on *Equisetum giganteum* and discovered it as a whitening agent (JP (Tokugan) 7-78478), but other plants having a whitening effect were not known until now. The inventors successfully perfected the present invention on the basis of the above-mentioned knowledge.

[0005] In essence, the present invention is a skin whitening agent for external use, characterized in that a plant extract of the genus *Equisetum* (excluding *Equisetum giganteum*) belonging to the family *Equiseatae* is added.

[0006] The structure of the present invention will now be described in detail. The plant of the genus *Equisetum* belonging to the family *Equiseatae* used in the present invention is *Equisetum arvense* L., *Equisetum hyemale* L., or *Equisetum debile* Roxb.

[0007] These plants are widely distributed throughout nature, but are plants that grow particularly well in dry grasslands, pastures, and the like. The plant extract used in the present invention is obtained by steeping or heat refluxing the leaves and stems or fruit, and the like, or the entire herb, of these plants together with an extraction solvent, then filtering the product, and concentrating the filtrate. The extraction solvent used in the present invention can be any solvent normally used for

extraction, and in particular, organic solvents including alcohols such as methanol and ethanol, hydrated alcohols, acetone, and ethyl acetate ester can be used alone or in combination with one another.

[0008] The amount of plant extract of the genus *Equisetum* belonging to the family *Equiseatae* used in the present invention is 0.005 to 20.0 wt %, preferably 0.01 to 10.0 wt %, of dry product in the total amount of agent for external use. When the amount is less than 0.005 wt %, the results of the present invention are not realized to their full potential, but an amount exceeding 20.0 wt % is undesirable because it is difficult to produce a pharmaceutical preparation. Moreover, a large improvement in the effect is not seen when the amount exceeds 10.0 wt %.

[0009] In addition to the above-mentioned essential ingredients, the skin whitening agent for external use of the present invention can contain as needed components that are used in skin agents for external use, such as ordinary cosmetics and drugs. For instance, other whitening agents, humectants, antioxidants, oils, UV absorbers, surfactants, gelling agents, alcohols, powders, pigments, aqueous components, water, and various skin nutrients can be arbitrarily added.

[0010] It is also possible to arbitrarily add metal sequestering agents, such as disodium edetate, trisodium edetate, sodium citrate, sodium polyphosphate, sodium metaphosphate, and gluconic acid; drugs, such as caffeine, tannin, verapamil, tranexamic acid and derivatives thereof, /3 licorice extracts, glabridine, hot-water extracts of the fruit of kakyoku, various crude drugs, tocopherol acetate, and glycyrrhyzic acid and derivatives or salts thereof; other whiteners, such as vitamin C, magnesium ascorbyl phosphate, glucoside ascorbate, arbutin, and kojic acid; and saccharides, such as glucose, fructose, mannose, sucrose, and trehalose.

[0011] There are no special restrictions to the preparation form of the skin whitening agent for external use of the present invention, and it can be used in any conventional skin agent for external use, such as an ointment, cream, emulsion, lotion, pack, bath, and the like.

[0012]

[Working Examples] The present invention will now be described in further detail with working examples. It should be noted, however, that the present invention is not limited to these working examples. The amounts added are wt %. These working examples will be preceded by

description of the methods used to test the melanin-inhibiting effect, tyrosinase activity-inhibiting effect and whitening effect of the plant extract of the present invention and the results thereof.

[0013] Test methods and results thereof

1. Preparation of samples

50 g of the stems and branches of the genus *Equisetum* belonging to the family *Equiseatae* were soaked for one week in ethanol at room temperature, and the extract was concentrated to obtain 5.2 g of ethanol extract. This extract was dissolved in 1 % DMSO, the solution was diluted to adjust the concentration, and the product was used in the experiments described below.

[0014]

2. Cell culture method

Mouse-derived B16 melanoma cultured cells were used. The cells were cultured under conditions of 37° C in a CO_2 incubator (95 % air, 5 % carbon dioxide)in Eagle's MEM medium containing 10 % FBS and theophylline (0.9 mg/mL). After 24 hours of culturing, sample solution was added to bring the final concentration (concentration in terms of dry extract) to 10^{-2} to 10^{-5} wt %, culturing was continued for another three days, and the amount of melanin produced

was macroscopically evaluated and the tyrosinase activity-inhibiting effect was determined by the following methods.

[0015] 3. Macroscopic determination of amount of melanin

A spread plate was placed on top of the lid of a well plate and the amount of melanin inside the cells was observed under an inverted microscope and compared to a sample containing no plant extract of the genus *Equisetum* belonging to the family *Equiseatae* (standard). Table 1 shows the results. Moreover, by way of reference, the same test as described above was performed on the extract of schizonepeta herb (*Schizonepeta tenuifolia*) extract known to have melanin production-inhibiting activity. Table 1 also shows these results.

[0016]<Evaluation Criteria>

O: White (amount of melanin)

Δ: Somewhat white (amount of melanin)

X: Standard (amount of melanin)

[0017] 4. Determination of tyrosinase activity

Prior to determination, the medium was removed from the well and washed twice using 100 μL of PBS. 45 μL of PBS containing 1 % Triton X (Rohm and Haas, brand name, surfactant) was added to each well. The plate was shook for one minute to thoroughly break down the cell membrane and absorbance at 475 nm was determined using a microplate

reader. This served as the absorbance at 0 minutes. Then 5 μL of a 10 mM L-DOPA solution was quickly added and the mixture was transferred to a 37° C incubator and reacted for 60 minutes. The plate was shaken for one minute and absorbance (475 nm) at 60 minutes was determined. The tyrosinase activity inhibition rate (%) was the increment reduction in the difference in absorbance at 0 and 60 minutes of the sample to which plant extract had been added versus the above-mentioned difference in absorbance of the sample that did not contain plant extract (control). Table 1 shows the results.

[0018] Moreover, the same test as described above was also conducted on the extract of schizonepeta herb (*Schizonepeta tenuifolia*) extract known to have a tyrosinase activity-inhibiting effect. Table 1 also shows these results. It should be noted that the - in the table indicates that there was not a significant difference by a significance level of 5 % or less when compared to the control.

[0019][[Table 1]

Test	Melanin production macroscopic evaluation				Tyrosinase activity inhibition rate (%)			
Concentration (wt %)	10^{-5}	10^{-4}	10^{-3}	10^{-2}	10^{-}	10^{-4}	10^{-3}	10^{-2}
Equisetum arvense L. extract	x	x	x	O	-	-	36	98
Equisetum hyemale L.	x	x	x	O	-	-	37	97
Equisetum debile Roxb. extract	x	x	x	O	-	-	38	98
Schizonepeta herb	x	x	x	x	-	-	-	55

[0020] 5. Whitening effect tests

[Test method] Using as the subject skin on the inside of the upper arm of 40 volunteers exposed for four hours to sunlight in the summer months (two days for 2 hours/day), each sample was applied once in the morning and once in the evening for four weeks beginning five days after the day of exposure to sunlight. The panel was five groups of eight

each and the test was conducted using the compositions listed below.

(Alcohol phase)

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95 % ethanol	55.0 wt %
Polyoxyethylene (25 moles) hydrogenated castor oil ether	2.0
Antioxidant/preservative	As needed
Fragrance	As needed
Drug (refer to Table 2)	
Aqueous phase	
Glycerin	5.0
Sodium hexametaphosphate	As needed
Deionized water	Balance

<Production method> The aqueous phase and alcohol phase were each prepared and then the two were mixed and solubilized.

[0021] [Evaluation method] The fading effect after use was evaluated by the following criteria.

<Evaluation criteria>

⊚ Case where the percentage of subjects showing an obvious response or a response was 80 % or greater

O: Case where the percentage of subjects showing an obvious response or a response was 50 % or greater but less than 80 %

Δ: Case where the percentage of subjects showing an obvious response or a response was 30 % or greater but less than 50 %

X: Case where the percentage of subjects showing an obvious response or a response was less than 30 %

[0022] A sample was prepared from the composition used in the above-mentioned testing method and the whitening effect was compared using the drugs in Table 2. Table 2 shows the results.

[0023]

[Table 2]

Drug	Amount added (wt %)	Effect
Nothing added	-	X
Hydroquinone	1.0	Δ
Equisetum arvense L. extract	0.1	O
Equisetum arvense L. extract	1.0	O

Equisetum arvense L. extract	10.0	◎
Equisetum hyemale L.extract	0.1	O
Equisetum hyemale L.extract	1.0	O
Equisetum hyemale L.extract	10.0	◎
Equisetum debile Roxb. extract	0.1	O
Equisetum debile Roxb. extract	1.0	O
Equisetum debile Roxb. extract	10.0	◎

[0024] It should be noted that the *Equisetum arvense* L. extract, *Equisetum hyemale* L. extract, and *Equisetum debile* Roxb. extract in Table 2 were obtained by heat refluxing the entire herb of these plants, then filtering the product, and concentrating the filtrate.

[0025] As is clear from Table 2, adding *Equisetum arvense L. extract*, *Equisetum hyemale L.*, or *Equisetum debile* Roxb. extract had the effect of preventing prevent excess melanin pigmentation and darkening after sunlight exposure.

[0026] Working Example 1 Cream

(Composition)

Stearic acid	5.0 wt %
Stearyl alcohol	4.0
Isopropyl myristate	18.0
Glycerin monostearic acid ester	3.0
Propylene glycol	10.0
Equisetum arvensae L. methanol extract	0.01
Potassium hydroxide	0.2
Sodium hydrogen sulfite	0.01
Preservative	Appropriate amount
Fragrance	Appropriate amount
Deionized water	Balance

(Production method) The propylene glycol, *Equisetum arvensae* L. methanol extract, and potassium hydroxide were added and dissolved in the deionized water, the mixture was heated, and the product was maintained at 70° C (aqueous phase). The other components were mixed, the mixture was heated and dissolved, and the product was maintained at 70° C (oil phase). The oil phase was gradually added to the aqueous phase. Once addition was over temperature was maintained for a time so that the mixture would react. The

product was uniformly emulsified using a homomixer and then cooled to 30° C while vigorously stirring.

[0027]

Working Example 2 Cream

(Composition)

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Stearic acid	2.0 wt %
Stearyl alcohol	7.0
Hydrogenated lanolin	2.0
Squalane	5.0
2-Octyldodecyl alcohol	6.0
Polyoxyethylene (25 moles) cetyl alcohol ether	3.0
Glycerin monostearic acid ester	2.0
Propylene glycol	5.0
Equisetum hyemale L. ethanol extract	0.05
Sodium hydrogen sulfite	0.03
Ethyl paraben	0.3
Fragrance	Appropriate amount
Deionized water	Balance

(Production method) The propylene glycol was added to the deionized water, the mixture was heated, and the product

was maintained at 70° C (aqueous phase). The other components were mixed, the mixture was heated and dissolved, and the product was maintained at 70° C (oil phase). The oil phase was added to the aqueous phase and preliminary emulsification was performed. The product was uniformly emulsified using a homomixer and then cooled to 30° C while being stirred.

[0028]

Working Example 3 Cream

(Composition)

Solid paraffin	5.0 wt %
Beeswax	10.0
Vaseline	15.0
Liquid Paraffin	41.0
Glycerin monostearic acid ester	2.0
Polyoxyethylene (20 moles) sorbitan monolauric acid ester	2.0
Soap powder	0.1
Borax	0.2
Equisetum debile Roxb. acetone extract	0.05

Equisetum arvense L. methanol extract	0.05
Sodium hydrogen sulfite	0.03
Ethyl paraben	0.3
Fragrance	Appropriate amount
Deionized water	Balance

(Production method) The soap powder and borax were added to the deionized water, the mixture was heated and dissolved, and the product was maintained at 70° C (aqueous phase). The other components were mixed, the mixture was heated and dissolved, and the product was maintained at 70° C (oil phase). The oil phase was gradually added to the aqueous phase and reacted while stirring. When the reaction was over, the product was uniformly emulsified using a homomixer and then cooled to 30° C while being stirred.

[0029]

Working Example 4 Emulsion

(Composition)

Stearic acid	2.5 wt %
Cetyl alcohol	1.5
Vaseline	5.0
Liquid paraffin	10.0

Polyoxyethylene (10 moles) monooleic acid ester	2.0
Polyethylene glycol 1500	3.0
Triethanolamine	1.0
Carboxyvinyl polymer (brand name: Carbopol 941, B. F. Goodrich Chemical Company)	0.05
Equisetum hyemale L. ethyl ester extract	0.01
Sodium hydrogensulfite	0.01
Ethyl paraben	0.3

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Fragrance	Appropriate amount
Deionized water	Balance

(Production method) The carboxyvinyl polymer was dissolved in a small amount of the deionized water (phase A). The polyethylene glycol 1500 and triethanolamine were added to the remaining deioinized water, the mixture was heated and dissolved, and the product was maintained at 70° C (aqueous phase). The other components were mixed, the mixture was heated and dissolved, and the product was maintained at 70° C (oil phase). The oil phase was added to the aqueous phase and preliminary emulsification was performed. Phase

A was added and the product was uniformly emulsified using a homomixer and after emulsification was cooled to 30° C while being stirred.

[0030]

Working Example 5 Emulsion

(Composition)

Microcrystalline wax	1.0 wt %
Beeswax	2.0
Lanolin	20.0
Liquid paraffin	10.0
Squalane	5.0
Sorbitan sesquioleic acid ester	4.0
Polyoxyethylene (20 moles) sorbitan monooleate ester	1.0
Propylene glycol	7.0
Equisetum debile Roxb. acetone extract	10.0
Sodium hydrogen sulfite	0.01
Ethyl paraben	0.3
Fragrance	Appropriate amount
Deionized water	Balance

(Production method) The propylene glycol was added to the deionized water, the mixture was heated, and the product

was maintained at 70° C (aqueous phase). The other components were mixed, the mixture was heated and dissolved, and the product was maintained at 70° C (oil phase). The aqueous phase was gradually added to the oil phase while stirring. The product was uniformly emulsified using a homomixer and after emulsification was cooled to 30° C while being stirred.

[0031]

Working Example 6 Jelly

(Composition)

95 % ethyl alcohol	10.0 wt %
Dipropylene glycol	15.0
Polyoxyethylene (50 moles) oleyl alcohol ether	2.0
Carboxyvinyl polymer (brand name: Carbopol 941, B. F. Goodrich Chemical Company)	1.0
Sodium hydroxide	0.15
L-arginine	0.1
Equisetum arvense L. 50 % ethanol aqueous solution	7.0

extract	
Sodium 2-hydroxy-4-	0.05
methoxybenzophenonsulfonate	
Ethylenediaminetetraacetate	0.05
trisodium dihydrate	
Methylparaben	0.2
Fragrance	Appropriate amount
Deionized water	Balance

(Production method) The Carbopol 940 was uniformly dissolved in the deionized water, while the *Equisetum arvense* L. 50 % ethanol aqueous solution extract and polyoxyethylene (50 moles) oleyl alcohol ether were dissolved in the 95 % ethanol and added to the aqueous phase. Next, the other components were added and the mixture was neutralized and gelled using the sodium hydroxide and L-arginine.

[0032]

Working Example 7 Beauty lotion

(Composition)

(Phase A)

Ethyl alcohol (95 %)	10.0 wt %
Polyoxyethylene (20 moles)	1.0
octyl dodecanol	

Pantothenyl ethyl ether	0.1

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Equisetum hyemale L. methanol extract	1.5
Methylparaben	0.15
(Phase B)	
Potassium hydroxide	0.1
(Phase C)	
Glycerin	5.0
Dipropylene glycol	10.0
Sodium hydrogen sulfite	0.03
Carboxyvinyl polymer (brand name: Carbopol 941, B. F. Goodrich Chemical Company)	0.2
Purified water	Balance

(Production method) Phases A and C were each uniformly dissolved and phase A was added to phase C and solubilized. Then B was added and the product was filled into a container.

[0033]

Working Example 8 Pack

(Composition)

(Phase A)

Dipropylene glycol	5.0 wt %
Polyoxyethylene (60 moles) hydrogenated castor oil	5.0
(Phase B)	
Equisetum debile Roxb. methanol extract	0.01
Olive oil	5.0
Tocopherol acetate	0.2
Ethyl paraben	0.2
Fragrance	0.2
(Phase C)	
Sodium hydrogen sulfite	0.03
Polyvinyl alcohol (degree of saponification of 90, degree of polymerization of 2,000)	13.0
Ethanol	7.0
Purified water	Balance

(Production method) Phases A, B, and C were each uniformly dissolved, and phase B was added to phase A and solubilized. Then this was added to phase C and the product was filled into a container.

[0034] Working Example 9 Solid Foundation

(Composition)

Talc	43.1 wt %
Kaolin	15.0
Sericite	10.0
Zinc oxide	7.0
Titanium dioxide	3.8
Yellow iron oxide	2.9
Black iron oxide	0.2
Squalane	8.0
Isostearic acid	4.0
Monooleic acid POE sorbitan	3.0
Isocetyl octanoate	2.0
Equisetum arvense L. ethanol extract	1.0
Preservative	Appropriate amount
Fragrance	Appropriate amount

(Production method) The powder components from the talc through the black iron oxide were thoroughly mixed with a blender and then the oily components from the squalane through the isocetyl octanoate, *Equisetum arvense* L. ethanol extract, preservative, and fragrance were added and the product was thoroughly needed. Then it was filled into a container and molded.

[0035]

Working Example 10 Emulsion-type foundation (cream type)

(Composition)

(Powder portion)

Titanium dioxide	10.3 wt %
Sericite	5.4
Kaolin	3.0
Yellow iron oxide	0.8
Red iron oxide	0.3
Black iron oxide	0.2

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(Oil phase)

Decamethylcycopentasiloxane	11.5
Liquid paraffin	4.5
Polyoxyethylene-modified dimethyl polysiloxane	4.0

(Aqueous phase)

Purified water	50.0
1,3-butylene glycol	4.5
Equisetum hyemale L. ethanol extract	1.5
Sorbitan sesquioleic acid ester	3.0
Preservative	Appropriate amount
Fragrance	Appropriate amount

(Production method) The aqueous phase was heated and stirred, and then the powder portion that had been thoroughly mixed and crushed was added and the product was treated with a homomixer. The oil phase that had been heated and mixed was further added and the product was treated with a homomixer. Then fragrance was added and the mixed was cooled to room temperature while stirring.

[0036]

[Effect of the Invention] As previously described, the skin whitening agent for external use of the present invention has melanin production-inhibiting activity and a tyrosinase activity-inhibiting effect, and is therefore a skin whitening agent for external use that has an excellent fading and whitening effect on pigmentation, discoloration, freckling, liver spots, and the like associated with sunburn, as well as excellent safety.